

AMENDMENTS TO THE SPECIFICATION

Please amend the specification by replacing the paragraph at page 1, line 2 of the current specification with the following paragraph:

This is a continuation-in-part of commonly-owned copending Continued Prosecution Application (CPA) No. 09/088,300, now Pat. No. 6,068,861, issued May 30, 2000, which continues the prosecution of prior commonly-owned copending Application No. 09/088,300, filed June 1, 1998.

Please amend the specification by adding the following paragraph at page 4, line 14 of the current specification:

In one of its embodiments this invention provides a process of producing a concentrated liquid biocide composition which comprises mixing (a) bromine chloride or bromine with (b) an aqueous solution of alkali metal salt of sulfamic acid (preferably the sodium salt), the solution having a pH of at least about 7, e.g., in the range of 7 to about 13.5, and preferably in the range of 7 to about 12. The amounts of (a) and (b) used are such that (i) the content of active bromine in the solution is at least 100,000 ppm (wt/wt) and (ii) the atom ratio of nitrogen to active bromine from (a) and (b) is greater than 1 when bromine is used, and greater than 0.93 when bromine chloride is used. It is preferred, however, to utilize an atom ratio of nitrogen to active bromine from (a) and (b) that is greater than 1 even when using bromine chloride in the process.

Please amend the specification by replacing the paragraph at page 5, line 14 of the current specification with the following paragraph:

By utilizing bromine or bromine chloride with caustic in the stabilized bromine composition, higher levels of active halogen are achievable, compared to the levels obtained by the addition of sodium hypochlorite to sodium bromide. The process and the compositions formed also have about twice the content of active bromine as the most concentrated

solutions produced pursuant to the Goodenough, et al. patent. Moreover, even at the high levels of active bromine that exist in the compositions of this invention, it has been found possible to provide biocidal compositions that maintain these high levels of active bromine for at least a two-month period, and that do not exhibit a visible or offensive vapor or odor during this period.

Please amend the specification by replacing the paragraph at page 11, line 1 of the current specification with the following paragraph:

A general procedure for preparing the compositions of this invention using sulfamic acid involves, as a first step, forming a slurry of sulfamic acid in water. Typically the pH of this slurry is below 1 pH unit. Sodium hydroxide at 50% concentration is then added until the solid is completely dissolved. Additional 50% NaOH is added until the desired pH is reached. Bromine or bromine chloride is then added at a rate to allow the bromine to dissolve and react with the sulfamic acid without forming a pool of halogen on the bottom of the reactor. On a laboratory scale, a convenient rate of addition is approximately two drops per second. Sodium hydroxide (e.g., 25% or 50%) is co-fed to the reactor to maintain the desired pH (e.g., in the range of about 12 to about 14, and preferably in the range of 12 to 13.5). It has been found that stable solutions containing as much as 26% active bromine (11.5% on an active chlorine basis) can be prepared by the process of this invention.

Please amend the specification by adding the following paragraphs at page 13, line 23:

EXAMPLE 4

Bromine Chloride, Caustic and Sodium Sulfamate at Neutral pH

A 1 liter flask was charged with 52.0 g of sulfamic acid and 250 g of water. Sodium sulfamate was prepared by adding 60.0 g of 50% sodium hydroxide to the stirred slurry. Bromine chloride was prepared by adding 20 g of chlorine to 47.0 g of bromine. This bromine chloride was then co-fed with 210 g of 25% sodium hydroxide to maintain the pH between 6 and 8. 5 mL of 1 M Hydrochloric Acid were added to bring the final pH to approximately 7 ± 0.5 . The solution, which contained some solids, was transferred to an

amber bottle for storage. Starch-iodine titration of a sample of the solution indicated that it had an active bromine concentration of 11.2%.

EXAMPLE 5

Bromine Chloride, Caustic and Sodium Sulfamate

A 1 liter flask was charged with 107 g of sulfamic acid and 200 g of water. Sodium sulfamate was prepared by adding 93.9 g of 50% sodium hydroxide to the stirred slurry. Bromine chloride was prepared by adding 39 g of chlorine to 96.0 g of bromine. This bromine chloride was then co-fed with 319 g of 50% sodium hydroxide to maintain the pH between 11 and 13. After stirring for an additional 30 minutes, the solution, which contained some solids, was transferred to an amber bottle for storage. Starch-iodine titration of a sample of the solution indicated that it had an active bromine concentration of 18.0%. Analysis of the solution after three weeks at ambient temperature indicated that the stabilized bromine solution still contained more than 90% of its active bromine content.

EXAMPLE 6

Bromine Chloride, Caustic and Sodium Sulfamate; larger scale

A 5 liter flask was charged with 470 g of sulfamic acid and 900 g of water. Sodium sulfamate was prepared by adding 436 g of 50% sodium hydroxide to the stirred slurry. Bromine chloride was prepared by adding 120 g of chlorine to 276 g of bromine. This bromine chloride was then co-fed with 1723 g of 50% sodium hydroxide to maintain the pH between 12 and 13. After stirring for an additional 60 minutes, the orange, clear solution was transferred to a polyethylene bottle for storage. Starch-iodine titration of a sample of the solution indicated that it had an active bromine concentration of 17.6%.